



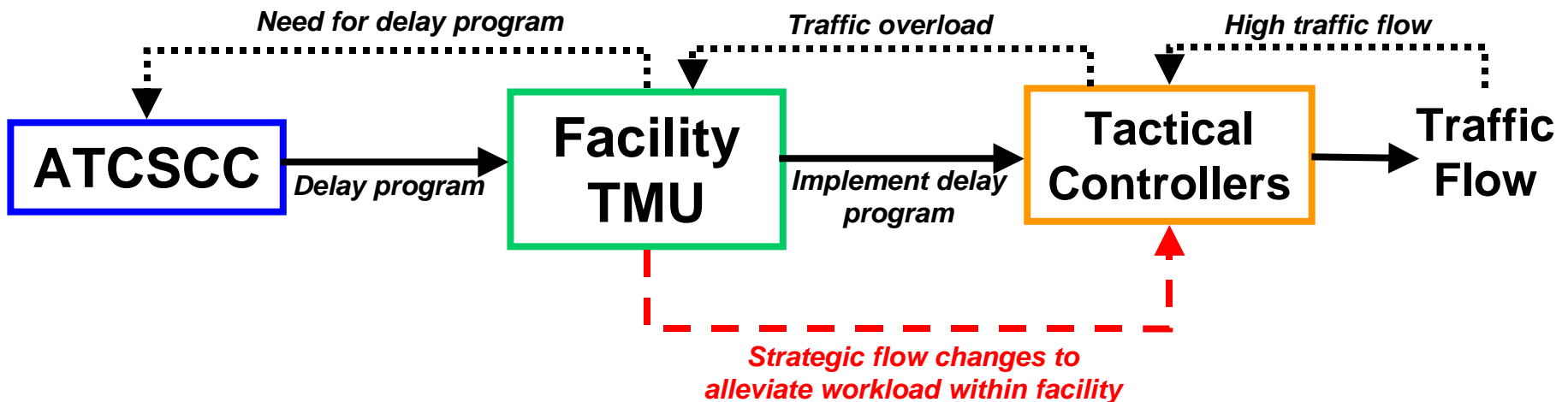
Investigating Air Traffic Control Communication & Coordination: Results of field studies

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Motivation

- Much of the current ATC communication research focuses on the high-level strategic communication such as CDM
- As the air traffic increases, we must strengthen the lower levels of strategic communication between facilities (e.g., TMUs) so that the system will be more flexible to handle disturbances



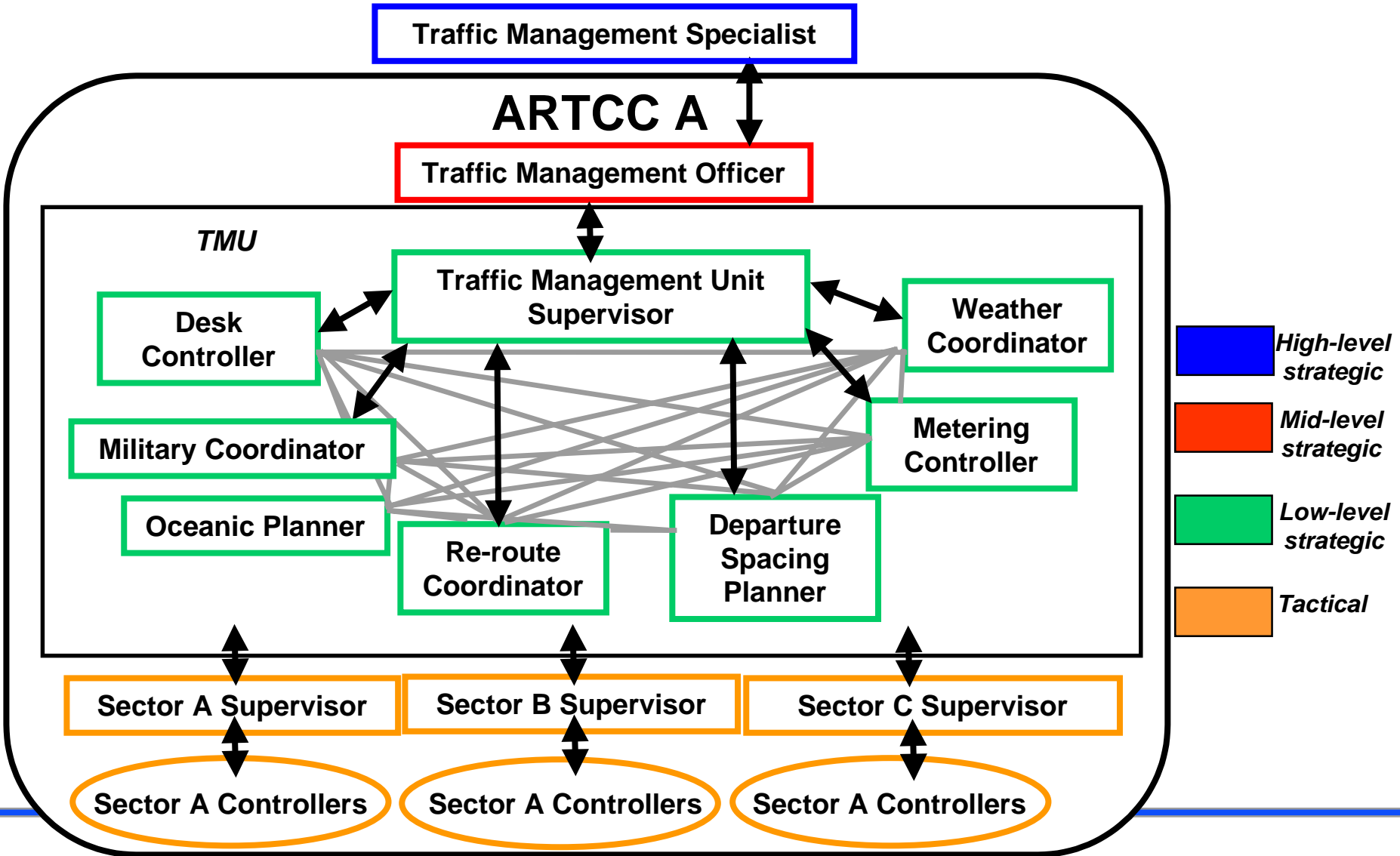
- There appears to be opportunities to improve information sharing at the inter-facility level



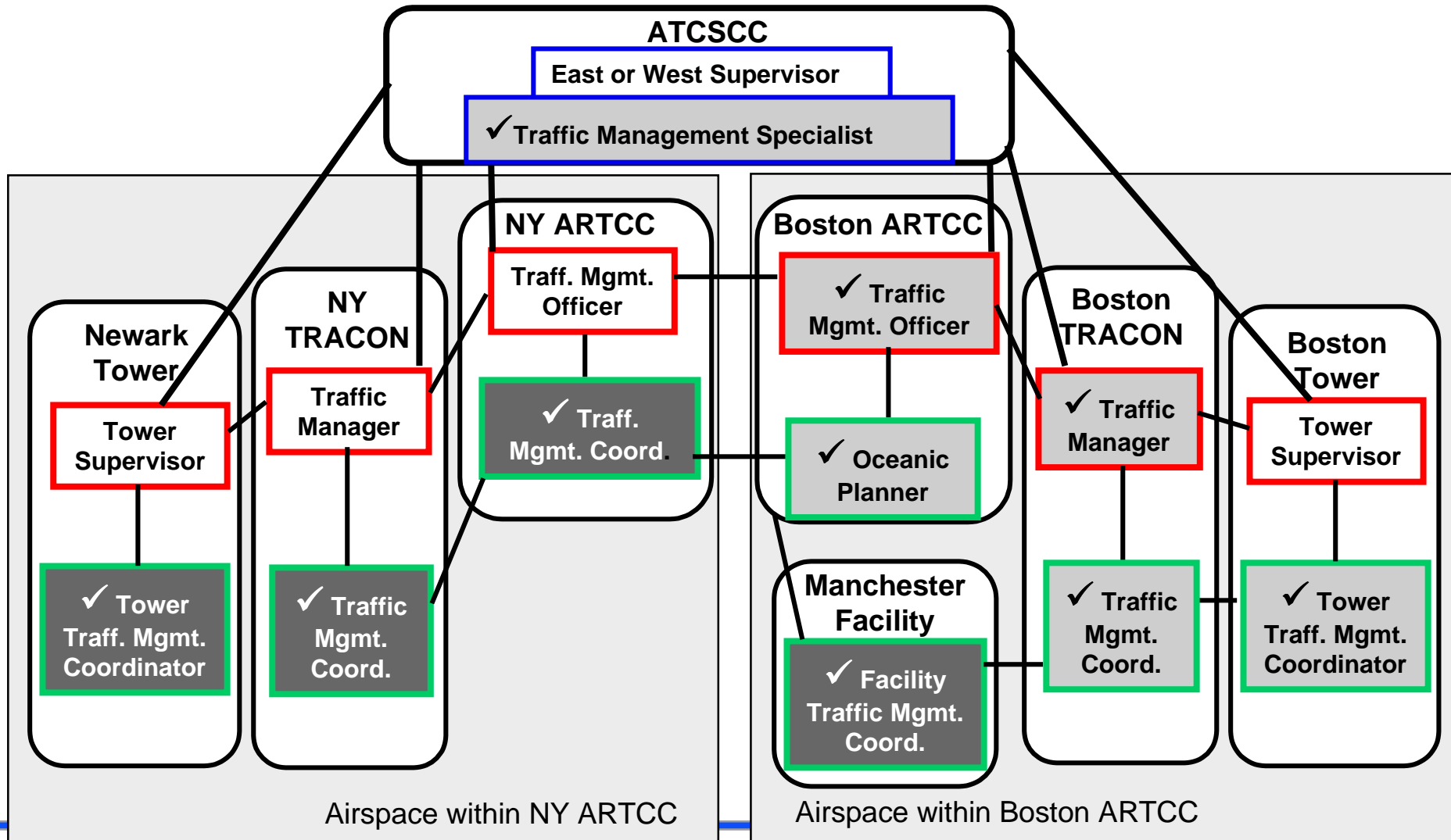
Approach

- **Perform series of focused interviews and field observations at single and multi-terminal ATC facilities**
 - ❑ Boston
 - ❑ New York
- **Identify current communication/coordination structure to investigate who, when and why they coordinate with others and how this coordination/communication can be improved**
- **Determine controllers' coordination and information needs & how it relates to bottlenecks in the ATC system**
- **Determine functional requirements for an integrated coordination system**

Facility Level Communication Structure- Example: ARTCC



Interviews with Low to High Level Strategic Controllers





A Comparison of Example Case Studies

- **Boston TRACON Traffic Management Coordinator**
- **New York TRACON Traffic Management Coordinator**

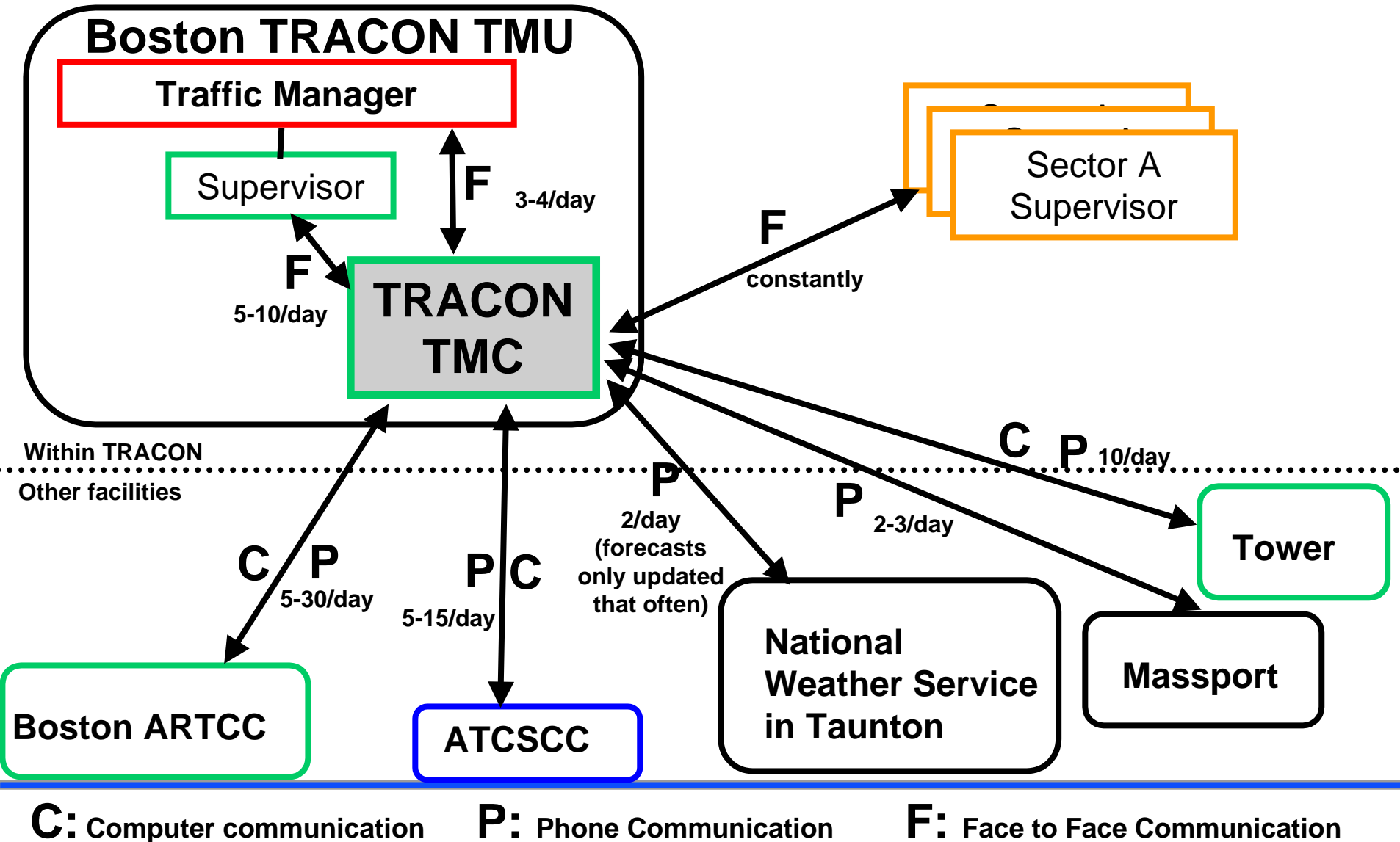


Traffic Management Coordinator Position

- Responsible for monitoring workload of floor controllers
- Responsible for determining restrictions needed to reduce high traffic flows into the facility
- Responsible for the timely communication of new restrictions from other facilities to the floor controllers
- Responsible for communicating and negotiating traffic initiatives with other facilities



Coordination Structure- Boston TRACON TMC Example





Information Tools Used by Boston TRACON TMC

- **Traffic Situation Display (TSD)**
 - ☐ Boston area traffic demand
- **Flight Data Information System/General Information Messages (FDIO/GI messages)**
 - ☐ Electronically communicating restrictions from ARTCC to TRACON and other regional facilities
- **National Weather Service (NWS) briefings**
 - ☐ 1/day by fax
- **Information Display System 4 (IDS-4)**
 - ☐ weather reports for airports
 - ☐ ILS used
 - ☐ runway configuration currently being used
 - ☐ approach charts
 - ☐ a/c recognition pictures



Communication & Coordination Problems (Boston)

- **Telephone problems coordinating with ARTCC & ATCSCC**
 - ☐ Phones not answered lead to delays for some aircraft up to 40 minutes
 - ☐ Could be remedied by automating certain re-routes
 - ☐ If controllers knew which aircraft were going to be on-time, early, late or going into holding, then they could plan better for flows
- **TMC's must manually type in restrictions to several tools**
 - ☐ FDIO/GI message system
 - ☐ IDS-4
 - ☐ ATC logs
- **The TMC position is often treated reactively instead of proactively**
 - ☐ Routes blocked by restrictions from ARTCC or Tower
 - ☐ TMC should seek out reason for restriction and try to suggest alternatives instead of just cutting off traffic flow
 - ☐ This proactive behavior often exhibited by TMC's who have worked at more than just the TRACON facility (TRACON & Tower, TRACON & ARTCC)

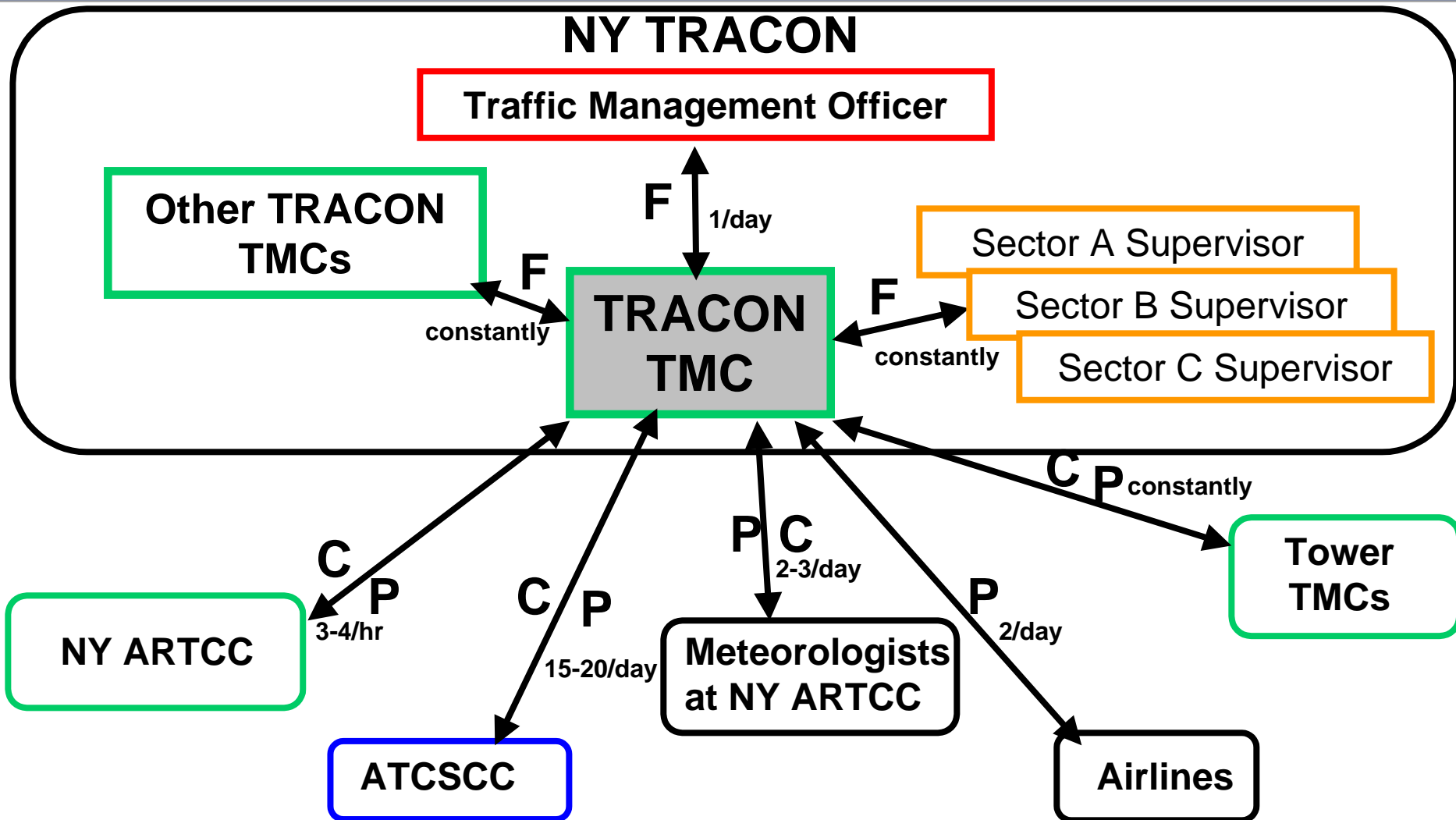


Boston TRACON TMC

- **Information quality is important to the TRACON TMC**
 - ❑ Weather forecasts (integrated from NWS, Center meteorologists and possibly Massport contractor if the first two contradict each other)
 - ❑ Demand forecasts (found fairly accurately from the TSD)
 - ❑ Individual work styles of area controllers
- **Ability to negotiate with TMCs from other facilities is critical**
 - ❑ Knowledge of structure and capacity of other facility
 - ❑ Knowledge of needs and wants of other facilities
 - ❑ Personal acquaintance with TMC makes it more likely to negotiate smoothly
- **This position is highly dependent on the individual TRACON TMC's ability to approach the limits of capacity without sacrificing safety**
- **Communication/Coordination Improvements**
 - ❑ Integrate information-sharing tools: FDIO/GI Messages, TSD, Information Display System (IDS)
 - ❑ Increase pro-active traffic flow management by educating TMCs about the structure and procedures in adjacent facilities



Coordination Structure- New York TRACON TMC Example



C: Computer communication **P**: Phone Communication **F**: Face to Face Communication



Information Tools Used by New York TRACON TMC

- Traffic Situation Display (TSD)
- Information Display System 4 (IDS-4)
- **NY ARTCC Weather Briefings**
 - ❑ 2/day by phone
- **Traffic Count Automation Program (TCAP)**
 - ❑ Hourly counts of traffic at each airport
- **Integrated Terminal Weather System (ITWS)**
 - ❑ Provides current weather information for New York area
 - ❑ Provides forecasted conditions 30 minutes into the future
- **Departure Spacing Planner (DSP)**
 - ❑ Information sharing tool between Towers, TRACON, & ARTCC in NY
 - ❑ Provides current departure sequence to reduce (and eventually eliminate) telephone calls for APREQ's
- **White board**
 - ❑ Used to communicate airport restrictions to TMU & floor controllers
- **Hotline (during severe weather traffic management)**
 - ❑ Used by Tower, TRACON, ARTCC, & ATCSCC to reroute individual aircraft



Communication & Coordination Problems (New York)

- **Age of telephones and communications equipment**
 - ☐ TMC's would like hands-free telephones & mobile phones to allow multi-tasking
- **APREQ procedures**
 - ☐ Tower telephones the TRACON every time that an aircraft tagged as an APREQ aircraft plans to depart
 - ☐ Remedy is DSP, which is in its testing phase
- **Method by which restrictions are passed to floor controllers**
 - ☐ Typed into ATCSCC computer log
 - ☐ Written on white board
 - ☐ Verbally to Liberty sector
 - ☐ Verbally to other TMC's
 - ☐ Faxed to all Towers
 - ☐ Phone 4 major towers to make sure the restrictions are received



New York TRACON TMC

- **Information quality is important to the TRACON TMC**
 - ❑ Determining demand for each of the major airports
 - ❑ Determining workload from the floor controllers, especially that of the Liberty sector
 - ❑ Especially important to get information disseminated timely to floor controllers, other TMCs, and Tower facilities
 - ❑ State-of-the-art weather information available from ITWS
- **Ability to negotiate with TMCs from other facilities is critical**
 - ❑ Much of the bottlenecks found in New York were found to begin from extreme restriction imposed on the facilities on aircraft going to ORD from the Cleveland ARTCC
 - ❑ Critical to be able to maximize departures by negotiating with NY ARTCC & to other ARTCC's through the ATCSCC
 - ❑ Critical to maximize arrivals into all airports, especially Newark by communicating efficiently with the Tower TMC's
- **Coordination/Communication Improvements**
 - ❑ So many restrictions imposed on TRACON, much of TMC's job consists of communicating the restrictions to the floor controllers & Tower TMC's— minimize “restrictions logging”, and other tasks
 - ❑ TMC's could be encouraged to work more proactively towards traffic management solutions, but facility is so busy just reacting to new restrictions, especially during SWAP, that proactive solutions are nearly impossible
 - ❑ More information sharing tools similar to DSP should be implemented to reduce amount of communications that occur between facilities and to maximize efficiency of communications that do exist



Differences between TMC positions at Boston and New York

- **Number of major airports controlled**
 - ❑ Boston: 1, New York: 3 (probably 4)
- **Size of TRACON TMU**
 - ❑ Boston: 1 person, New York: 5-7 people
 - ❑ Group communications increased at NY to ensure proper restriction updating that may affect traffic management decisions
- **Amount of restrictions imposed on TRACONs**
 - ❑ Boston receives much fewer restrictions than NY
 - ❑ Boston more able to proactively get involved in re-routing flows without many “snowballing” problems resulting (more flexible TFM)
 - ❑ New York TMU is working more reactively to restrictions imposed and they do not have time to take more proactive measures that would not significantly disrupt standard operating procedures (less flexible TFM)
- **Type of communications occurring**
 - ❑ Boston spends communications asking why certain restrictions put on them from ARTCC
 - ❑ NY spends most communications receiving calls from Towers to clarify restrictions and receiving APREQ's, or convincing ARTCC or ATCSCC why restrictions are needed



Emerging Themes

- **Areas of Protection**

- ☐ Each area (e.g., sector, facility, region) operates to its maximum risk threshold to maximize the efficiency without sacrificing safety
- ☐ Different risk thresholds for different facilities- (Providence Tower v. Boston Tower, Cleveland ARTCC v. NY ARTCC)

- **Ambiguous ATC Organizational Structure**

- ☐ ATC is currently functioning under a centralized structure with ATCSCC at the top
- ☐ Since little power given to ATCSCC, many ARTCCs function as a decentralized system with each ARTCC in charge of its own airspace with the ATCSCC as mediator
- ☐ TMCs are confused about the function of the ATCSCC facility

- **Lack of “system” concern**

- ☐ As long as the area is functioning at capacity, the controllers are not concerned with other areas

- **Personal Negotiations**

- ☐ Personal communication & negotiation is used to battle the “Lack of system concern” mentality
- ☐ Visiting other facilities on a regular basis helps
 - Develop personal acquaintances at other facilities
 - o Easier to negotiate with an acquaintance or friend
 - o Understand state of other person better (able to distinguish a critical situation from a non-critical situation, able to predict the saturation point of other individual)
 - Bigger picture of system impact
 - o Can see what effect implementing a delay initiative has on other facilities
 - o Can take a proactive position during a negotiation with other facility



Opportunities to Enhance ATC Traffic Management

- **Integrated information sharing tools**
 - ❑ DSP will eventually significantly reduce excess communications between Towers and TRACON at New York
 - ❑ Other tools like the IDS-4 and the FDIO/GI message system should be integrated to reduce inputting the same data into several sources and minimize time to communicate restrictions from TMU to floor controllers
- **Encouraging pro-active traffic management**
 - ❑ By reducing excess communications between facilities, TMC's could have more time to be monitoring TSD demand and arranging proactive traffic management routes to address restrictions imposed on their facility
- **Investigating further the significance of personal communications among individuals**
 - ❑ When do personal negotiations change the traffic management strategy used
 - ❑ What aspects of personal negotiation give the TMCs leverage in negotiations
 - previous facilities worked
 - personal acquaintances
 - empathy for controllers at other facility
 - tit-for-tat